WHAT IS CLAIMED IS:

1. A plasma processing apparatus for supplying radio-frequency power into a process chamber so as to generate plasma, to thereby treat an object to be processed with the plasma;

wherein the process chamber has a top plate which is disposed opposite to the object to be processed, through the medium of a region for generating the plasma; and a radio-frequency antenna is disposed in the inside and outside of the process chamber so that the radio-frequency antenna is wound around the top plate.

2. A plasma processing apparatus according to claim 1, wherein at least one metal-based radio-frequency antenna is disposed, in the process chamber, so as to provide a linear and/or curved line.

3. A plasma processing apparatus according to claim 1, wherein the radio-frequency antenna disposed in the process chamber is covered with an insulating material so that the radio-frequency antenna does not directly contact the plasma.

4. A plasma processing apparatus according to claim 1, wherein the length of the radio-frequency antenna disposed in the process chamber is not smaller than $(n/2-1/4)\lambda_0$ (wherein $\lambda_0$ is the wavelength of the radio-frequency power, and n is an integer) and not larger than $(n/2+1/4)\lambda_0$.

5. A plasma processing apparatus according to claim 1, wherein the thickness or diameter of the radio-frequency antenna disposed in the process chamber is changed along with the propagation direction of the radio-frequency power

6. A plasma processing apparatus according to claim 1, wherein the radio-frequency antenna is disposed in the process chamber, so that the density of the radio-frequency antenna arrangement is changed with respect to the central portion and peripheral portion of the process

chamber, and/or with respect to the height direction of the process chamber.

7. A plasma processing apparatus according to claim 3, wherein an insulating fluid is circulated between the radio-frequency antenna disposed in the process chamber, and the insulating material.

8. A plasma processing apparatus according to claim 1, wherein the distance between the top plate and the radio-frequency antenna disposed in the process chamber is variable.

9. A plasma processing apparatus according to claim 1, wherein a measuring device is disposed in at least one position of the top plate so as to monitor the state of the generated plasma.

10. A plasma processing apparatus according to claim 1, wherein the top plate has a plurality of apertures for passing a gas to be supplied to the process chamber.

11. A plasma processing apparatus according to claim 1, wherein a susceptor for supporting the object to be processed is disposed in the process chamber, and a bias is applied to the susceptor.

12. A plasma processing apparatus according to claim 1, wherein at least a portion of the ground line in the process chamber has an opening, and the plasma is generated due to the radiation of a microwave electric field from the opening toward the outside of the ground line.

13. A plasma processing apparatus for supplying radio-frequency power into a process chamber so as to generate plasma, to thereby treat an object to be processed with the plasma;

wherein the process chamber has a top plate which is disposed opposite to the object to be processed through the medium of a region for generating the plasma; and the top plate comprises a metal-based or silicon-based material.

14. A plasma processing apparatus according to claim 13, wherein at least one metal-based radio-frequency antenna is disposed, in the process chamber, so as to provide a linear and/or curved line.

15. A plasma processing apparatus according to claim 14, wherein the radio-frequency antenna disposed in the process chamber is covered with an insulating material so that the radio-frequency antenna does not directly contact the plasma.

16. A plasma processing apparatus according to claim 14, wherein the length of the radio-frequency antenna disposed in the process chamber is not smaller than $(n/2-1/4)\lambda_0$ (wherein $\lambda_0$ is the wavelength of the radio-frequency power, and n is an integer) and not larger than $(n/2+1/4)\lambda_0$.

17. A plasma processing apparatus according to claim 14, wherein the thickness or diameter of the radio-frequency antenna disposed in the process chamber is changed along with the propagation direction of the radio-frequency power

18. A plasma processing apparatus according to claim 14, wherein the radio-frequency antenna is disposed, in the process chamber, so that the density of the radio-frequency antenna arrangement is changed with respect to the central portion and peripheral portion of the process chamber, and/or with respect to the height direction of the process chamber.

19. A plasma processing apparatus according to claim 15, wherein an insulating fluid is circulated between the radio-frequency antenna disposed in the process chamber, and the insulating material.

20. A plasma processing apparatus according to claim 14, wherein the distance between the top plate and the radio-frequency antenna disposed in the process chamber is variable.

21. A plasma processing apparatus according to

claim 14, wherein a measuring device is disposed in at least one position of the top plate so as to monitor the state of the generated plasma.

22. A plasma processing apparatus according to claim 14, wherein the top plate has a plurality of apertures for passing a gas to be supplied to the process chamber.

23. A plasma processing apparatus according to claim 14, wherein a susceptor for supporting the object to be processed is disposed in the process chamber, and a bias is applicable to the susceptor.

24. A plasma processing apparatus according to claim 14, wherein at least a portion of the ground line in the process chamber has an opening, and the plasma is generated due to the radiation of microwave electric field from the opening toward the outside of the ground line.